# Sweet Corn Plastic Mulch Comparison

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## Introduction

Early sweet corn production is enhanced by use of clear plastic mulch. Some growers use this practice on their earliest plantings to gain a market advantage and higher price. In cool, wet springs the practice is highly profitable. In central and northern Iowa, the years with a yield advantage more than offset the costs for years with no gain. There are many color plastic choices with various advertised benefits such as increased soil temperature and reflective radiation that speeds plant growth and development. The sweet corn research is designed to evaluate a few color mulches that are reported to affect corn growth and development—specifically, the sugar content of the kernel at harvest. The blue is supposed to enhance photosynthesis and improve translocation of carbohydrates (sucrose) to the developing kernel. As sweet corn is harvested in the immature stage (as opposed to field corn) it is thought there might be a sugar boost (some Canadian work was indecisive). The mulches were manufactured using pigment resins of a proprietary nature that change the wavelength of reflective radiation – blue and red. Thus, we measured the reflective radiation to see if that is true. Some plastics are included that affect soil temperature more than reflective radiation (i.e, the olive and clear). Increasing soil temperature and resultant enhanced shoot growth and leaf surface area may have more to do with photosynthesis and sugar production than specific reflective radiation.

The objective of this study was to evaluate early sweet corn production grown on various colored plastic mulches for maturity, yield, ear characteristics, and kernel sugar content.

## Materials and Methods

The project was established at the Horticulture Research Station (central Iowa – a well-drained loam soil). The previous crop was tomatoes. The site was fertilized according to soil test recommendations. The cultural system consisted of plastic mulch and trickle irrigation. Irrigation scheduling was via tensiometers. The necessary fertilizer was broadcast and rotovated in prior to laying the plastic mulches. Before laying the mulch, herbicides Bladex 90DF and Dual II were broadcast at labeled rates. Pest management for earworm corn borer control consisted of Warrior-T applied at row-tassel and every 4 to 5 days during silk development. An early seed variety, Temptation, was seeded by punching through the plastic every 9 in. in-row on May 16. Three seeds were dropped per hole. Individual plot size was 2 rows at 30 ft length, 6-ft on center, with twin rows spaced 18 in. apart.

Plastic mulch treatments consisted of: none or bare ground, olive, blue, red, and clear provided by Pliant Corporation, Washington, GA. All materials were 4-ft wide and 0.00125 in. thick with differing spectral properties. All treatments were arranged in a randomized complete block design with four replications.

Growth measurement data consisted of emergence percentage and seedling dry weight at the V6 stage of growth. Yield data included number of marketable ears and ear characteristics as weight, length, diameter, tip fill, kernel row, and kernel Brix percentage as measured by refractometer.

## Results and Discussion

Seeding was delayed to May 16 from the target date of May 1 because of heavy spring rains. The growing season was cool and wet, favoring a response to clear plastic mulch. Table 1 indicates the radiation qualities of the plastic types. Bare, dry soil had a reflective value of 400 $\mu E/m^2/sec$ while the olive plastic reflected almost 50% less, at 220 400 $\mu E/m^2/sec$. Clear mulch was the most reflective – similar to bare soil. The red and blue plastic mulch have translucent properties allowing almost 2-fold the radiation to pass through, compared with olive mulch. Of course, clear mulch allowed 92% of direct sunlight to pass through. Translucent properties may be of great benefit in cool springs and wet soil conditions for advancing plant growth.

Although the blue plastic mulch had the earliest germination by visual estimation, the bare and olive plastic mulch appeared to have the lowest germination (89.2% compared with 92.7% for the other three), but there was no statistical difference among the plastic types (Table 2). This apparent effect carried through to June 18 when shoot growth rate was lowest for the bare and olive plastic treatments. However, by July 8 the clear plastic corn was the earliest maturing, with 100% of the plants silking followed by red and then blue mulches. The olive mulch and bare plot sweet corn were the least advanced in maturity.

*Yield*. Plots were harvested when kernels were fully developed and moisture content was estimated at approximately 72% by the thumbnail test. Table 3 indicates no statistical difference (P = 0.80) among the plastic mulch types for yield at first harvest (average of 1,123 doz/acre). However, compared with the bare ground and olive mulch treatments the clear plastic mulch advanced maturity by 3 to 4 days. The blue and red plastic mulch types were equivalent and only 1 to 2 days earlier than the bare ground and olive mulch treatments. For total yield, the olive plastic mulch produced the highest marketable yield of 1,632 doz/acre and bare ground the lowest yield of 1,341 doz/acre or 12.2% less than the olive mulch (P value = 0.07). The blue, clear, and red plastic mulches were intermediate and not different from each other.

*Kernel sugar***.** Table 5 indicates a statistical difference between the olive mulch (highest) and the bare soil (lowest) in kernel moisture percentage indicating a judgment error in harvest maturity. All plastic mulch treatments were similar in kernel moisture content at harvest. The kernel sugar content, as measured by Brix %, was not statistically different among the treatments. There was no correlation between kernel moisture and Brix concentration. The coefficient of variation was <10% indicating good uniformity among the replications. The trend was for the blue plastic mulch to be highest in kernel sugar content, but the value was not different from other plastic treatments.

*Ear characteristics.* Ear length and tipfill percentage were similar for all plastic mulch treatments (Table 6). There were slight differences for ear diameter and kernel row number. A smaller ear diameter and a higher kernel row number is generally associated with higher eating quality. The translucent plastic mulches (clear, blue, and red) resulted in the greatest effect. Blue plastic mulch had the largest ear diameter and olive mulch the smallest. Red plastic mulch had the highest row kernel count and bare soil the lowest.

**Table 1. Radiation (reflective and translucent) of sweet corn plastic mulches.[1]**

| Plastic Treatment | Reflective | Translucent |
|---|---|---|
| Bare | 400 | -- |
| Olive | 220 | 168 |
| Clear | 470 | 1380 |
| Red | 340 | 345 |
| Blue | 280 | 310 |

[1]Reflective radiation, $\mu E/m^2/sec$, measured 12 in. above the plastic surface at 10:30 am, June 1 – bright sun, no clouds. The sensor was a Li-Cor quantum sensor measuring energy in the 400 to 700 nm electromagnetic spectrum, the plant PAR range. Direct sunlight measured 1500 $\mu E/m^2/sec$. Translucent refers to radiation passing through the plastic. All values the mean of three measurements.

**Table 2. Germination of Temptation sweet corn as affected by plastic mulch color on May 29.[1]**

| Plastic mulch treatment | Germination, % | Shoot growth | Silking, % |
|---|---|---|---|
| Bare | 89.7 | 8.8 | 7.8 C |
| Olive | 88.7 | 8.6 | 0.8 C |
| Clear | 93.5 | 10.7 | 100.0 A |
| Red | 90.9 | 9.3 | 55.0 B |
| Blue | 93.6 | 9.2 | 35.3 B |
| Difference, $P < 0.05$ | ns | ns | ** |
| S.E.D $_{0.05}$[2] | 5.4 | 3.4 | 43.4 |

[1]Data collected on Germination, May 29. Shoot growth, as measured by shoot dry weight at the V6 stage of growth on June 18, and silking percentage determined July 8.
[2]The standard error of difference for comparison between plastic types. Values followed by the same letter are not different, $P = 0.05$.

**Table 3. Sweet corn, cv. Temptation, yield as affected by plastic mulch treatment**.

| | Harvest | ---- Yield, dozen/acre ---- | |
|---|---|---|---|
| Plastic mulch type | date in July | 1st harvest | Total |
| Bare | 29 | 1122 | 1341 B |
| Olive | 28 | 1128 | 1456 AB |
| Clear | 25 | 1025 | 1523 AB |
| Red | 30 | 1140 | 1632 A |
| Blue | 28 | 1201 | 1535 AB |
| Difference, $P < 0.05$ | -- | ns | $P = 0.07$ |
| S.E.D $_{0.05}$[1] | -- | 282 | 180 |

[1]The standard error of difference for comparison between plastic types. Values followed by the same letter are not different, $P < 0.05$.

**Table 4. Sweet corn, cv. Temptation, kernel moisture and Brix percentage determined at first harvest.**

| Plastic mulch treatment | Moisture, % | Brix, % |
|---|---|---|
| Bare | 70.3 B | 18.3 |
| Olive | 77.6 A | 18.9 |
| Clear | 71.5 AB | 18.0 |
| Red | 75.2 AB | 19.4 |
| Blue | 74.5 AB | 20.3 |
| Difference, P < 0.05 | * | ns |
| S.E.D. $_{0.05}$[1] | 6.0 | 2.6 |
| Coef. variability | 5.7 % | 9.4 % |

[1]The standard error of difference for comparison between plastic types.
Values followed by the same letter are not different, P < 0.05.

**Table 5. Ear characteristics of Temptation sweet corn as affected by plastic mulch treatments.**

| Plastic type | Length, in. | Diameter, in. | Tipfill, % | Kernel row, No. |
|---|---|---|---|---|
| Bare | 7.2 | 1.7 AB | 99.4 | 15.2 B |
| Olive | 7.2 | 1.7 B | 98.7 | 15.7 AB |
| Clear | 7.5 | 1.7 AB | 98.3 | 15.9 AB |
| Red | 7.2 | 1.8 AB | 99.2 | 16.3 A |
| Blue | 7.4 | 1.8 A | 99.7 | 16.1 AB |
| Difference, P < 0.05 | ns | ns | * | * |
| S.E.D. $_{.05}$[1] | 0.31 | 0.06 | 2.1 | 0.90 |

[1]The standard error of difference for comparison between plastic types.
Values followed by the same letter are not different, P < 0.05.

General plot showing Olive, red, and blue mulch on June 21. Seeding date was May 16.

Close-up of blue mulch in block 3 on June 21.